14. Compound Interest

Exercise 14.1

1. Question

Find the compound interest when principal = Rs. 3000, rate = 5% per annum and time = 2 years.

Answer

Given:

Principal =Rs.3000

Rate = 5%

Time = 2 years

Hence,

Compound interest $= P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 3000[(1+\frac{5}{100})^2-1] \quad = 3000((\frac{21}{20})^2-1)$

$= 3000(\frac{441-400}{400}) = 15\times\frac{41}{2} \quad = 307.5$

2. Question

What will be the compound interest on Rs. 4000 in two years when rate of interest is 5% per annum?

Answer

Given,

Principal = Rs.4000

Time = 2 years

Rate = 5 % per annum

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 4000\left[\left(1+\frac{5}{100}\right)^2-1\right) = \ 4000\left[\left(\frac{21}{20}\right)^2-1\right) = \ 4000\times\frac{41}{400} = Rs.410$

3. Question

Rohit deposited Rs. 8000 with a finance company for 3 years at an interest of 15% per annum. What is the compound interest that Rohit gets after 3 years?

Answer

Given,

Principal=Rs.8000

Time = 3 years

Rate = 15% p.a

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 8000\left[\left(1+\frac{15}{100}\right)^{3}-1\right] = 8000\left[\left(\frac{23}{20}\right)^{3}-1\right] = 8000\times\frac{4167}{8000} = Rs.\,4167$

4. Question

Find the compound interest on Rs. 1000 at the rate of 8% per annum for $1\frac{1}{2}$ years when interest is compounded half yearly.

Answer

Given,

Principal = Rs.1000

Rate = 8% p.a = $\frac{8}{2} = 4\%\ half\ yearly$

Time = $1\frac{1}{2}$ years = $\frac{3}{2}\times 2 = 3\ half\ year$

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 1000\left[\left(1+\frac{4}{100}\right)^{3}-1\right] = 1000\left[\left(\frac{26}{25}\right)^{3}-1\right] = 1000\times\frac{1951}{15625} = Rs.\,124.86$

5. Question

Find the compound interest on Rs. 160000 for one year at the rate of 20% per annum, if the interest is compounded quarterly.

Answer

Given,

Principal = Rs.160000

Rate = 20% p.a = $\frac{20}{4} = 5\%\ quartely$

Time = 1 year = $1\times4 = 4\ quarters$

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 160000\left[\left(1+\frac{5}{100}\right)^{4}-1\right] = 160000\left[\left(\frac{21}{20}\right)^{4}-1\right] = 160000\times\frac{34481}{160000} = Rs.\,34481$

6. Question

Swati took a loan of Rs. 16000 against her insurance policy at the rate of $12\frac{1}{2}$% per annum. Calculate the total compound interest payable by Swati after 3 years.

Answer

Given,

Principal = Rs.16000

Rate = $12\frac{1}{2}$%

Time = 3 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 16000\left[\left(1+\frac{25}{2\times100}\right)^{3}-1\right] = 16000\times\frac{217}{512} = Rs.\,6781.25$

7. Question

Roma borrowed Rs. 64000 from a bank for $1\frac{1}{2}$years at the rate of 10% per annum. Compare the total compound interest payable by Roma after $1\frac{1}{2}$years, if the interest is compounded half-yearly.

Answer

Given,

Principal = Rs. 64000

Time = $1\frac{1}{2}$years = $\frac{3}{2}\times2 = 3\ half\ years$

Rate= 10% = $\frac{10}{2} = 5\%\ half\ yearly$

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 64000\left[\left(1+\frac{5}{100}\right)^{3}-1\right] = 64000\times\frac{1261}{8000} = Rs.\,10088$

8. Question

Mewa lal borrowed Rs. 20000 from his friend Rooplal at 18% per annum simple interest. He lent it to Rampal at the same rate but compounded annually. Find his gain after 2 years.

Answer

Given,

Principal= Rs. 20000

Rate = 18% p.a

Time = 2 years

Hence,

Interest that Mewa lal has to pay = $simple\ interest = \frac{P \times R \times T}{100} = \frac{20000 \times 18 \times 2}{100} = Rs.7200$

And,

Interest paid by Rampal to Mewalal = Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 20000\left[\left(1+\frac{18}{100}\right)^{2}-1\right] = 20000 \times \frac{981}{2500} = Rs7848$

Gain of Mewa lal = Rs.(7848 – 7200) = Rs. 648

9. Question

Find the compound interest on Rs. 8000 for 9 months at 20% per annum compounded quarterly.

Answer

Principal = Rs.8000

Time =9 months

Rate = 20% per annum

∵ Interest is compounded quarterly, So Rate of interest will be counted as 20/4 = 5% and time will be 9/3 = 3 Quarter

We know that, $A = P \times \left(1+\frac{R}{100}\right)^{t}$

$\Rightarrow A = 8000 \times \left(1+\frac{5}{100}\right)^{3}$

$\Rightarrow A = 8000 \times \left(\frac{105}{100}\right)^{3} = Rs.9261$

Hence, Compound Interest = Rs. 9261 – Rs 8000 = Rs. 1261

10. Question

Find the compound interest at the rate of 10% per annum for two years on that principal which in two years at the rate of 10% per annum given Rs. 200 as simple interest.

Answer

Given,

Rate of simple interest = 10%

Time = 2 years

Simple interest = RS.200

So,

$= simple\ interest = \frac{P \times R \times T}{100}$

$= 200 = \frac{P \times 2 \times 10}{100}$

$= P = Rs.1000$

Rate of compound interest = 10%

Time = 2years

$= \text{Compound interest} = P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 1000\left[\left(1+\frac{10}{100}\right)^{2}-1\right]$

$= 1000\left[\left(\frac{11}{10}\right)^{2}-1\right] = 1000 \times \frac{21}{100} = Rs.210$

11. Question

Find the compound interest on Rs. 64000 for 1 year at the rate of 10% per annum compounded quarterly.

Answer

Given,

Principal = Rs.64000

Time = 1 year = 1×4 = 4 quarters

$\text{Rate} = 10\% = \frac{10}{4} = \frac{5}{2}\%\ quarterly$

Hence,

$\text{Compound interest} = P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 64000\left[\left(1+\frac{5}{200}\right)^{4}-1\right]$

$= 64000\left[\left(\frac{41}{40}\right)^{4}-1\right] = 64000 \times \frac{265761}{2560000} = Rs.6644.03$

12. Question

Ramesh deposited Rs. 7500 in a bank which pays him 12% interest per annum compounded wuarterly. What is the amount which he receives after 9 months.

Answer

Given,

Principal = Rs.7500

Rate = 12% = $\frac{12}{4} = 3\ \%\ quarterly$

Time = 9 months = $\frac{9}{12} years\ = \frac{9}{12} \times 4 = 3\ quarters$

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 7500\left[\left(1+\frac{3}{100}\right)^{3}-1\right]$

= $7500 \times \frac{92727}{1000000} = Rs.695.45$

Amount he receives after 9 months = principal + compound interest

= 7500+695.45 = Rs.8195.45

13. Question

Anil borrowed a sum of Rs. 9600 to install a handpump in his dairy. If the rate of interest is $5\frac{1}{2}\%$ per annum compounded annually, determine the compound interest which Anil will have to pay after 3 years.

Answer

Given,

Principal = Rs. 9600

Rate of interest = $5\frac{1}{2}\%$ = $\frac{11}{2}\%\ annually$

Time = 3 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 9600\left[\left(1+\frac{11}{2\times100}\right)^{3}-1\right]$

= 9600× 0.174 = Rs.1672.72

So,

Compound interest paid by Anil after 3 years = Rs.1672.72

14. Question

Surabhi borrowed a sum of Rs. 12000 from a finance company to purchase a refrigerator. If the rate of interest is 5% per annum compounded annually, calculate the compound interest that Surabhi has to pay to the company after 3 years.

Answer

Given,

Principal = Rs.12000

Rate = 5%

Time = 3 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=12000\left[\left(1+\frac{5}{100}\right)^{3}-1\right]$

$=12000\left[\left(\frac{21}{20}\right)^{3}-1\right]=12000\times\frac{1261}{8000}=Rs.1891.50$

So,

Compound interest paid by Surabhi to the company = Rs.1891.50

15. Question

Daljit received a sum of Rs. 40000 as a loan from a finance company. If the rate of interest is 7% per annum compounded annually, calculate the compound interest that Daljit pays after 2 years.

Answer

Given,

Principal = Rs.40000

Rate of interest = 7 %

Time = 2 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=40000\left[\left(1+\frac{7}{100}\right)^{2}-1\right]$

$=40000\left[\left(\frac{107}{100}\right)^{2}-1\right]=40000\times\frac{1449}{10000}=Rs.5796$

So,

Compound interest paid by Daljit = Rs.5796

Exercise 14.2

1. Question

Compute the amount and the compound interest in each of the following by using the formulae when :

(i) Principal = Rs. 3000, Rate = 5%, Time = 2 years

(ii) Principal = Rs. 3000, Rate = 18%, Time = 2 years

(iii) Principal = Rs. 5000, Rate = 10 paise per annum, Time = 2 years

(iv) Principal = Rs. 2000, Rate = 4 paise per annum, Time = 3 years

(v) Principal = Rs. 12800, Rate = $7\frac{1}{2}$%, Time = 3 years

(vi) Principal = Rs. 10000, Rate = 20% per annum compounded half-yearly, Time = 2 years

(vii) Principal = Rs. 160000, Rate = 10 paise per rupee per annum compounded half yearly, Time = 2 years.

Answer

(i) Given,

Principal = Rs.3000

Rate = 5%

Time = 2 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=3000\left[\left(1+\frac{5}{100}\right)^{2}-1\right]$

$=3000\left[\left(\frac{21}{20}\right)^{2}-1\right]=3000\times\frac{41}{400}=Rs.307.50$

Amount = principal + Compound interest

= 3000 + 307.50 = Rs. 3307.50

(ii) Given,

Principal = Rs.3000

Rate = 18%

Time = 2 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=3000\left[\left(1+\frac{18}{100}\right)^{2}-1\right]$

$=3000\left[\left(\frac{59}{50}\right)^{2}-1\right]=3000\times\frac{981}{2500}=Rs1177.20$

Amount = Principal + compound interest

= 3000 + 1177.20 = Rs.4177.20

(iii) Given,

Principal = Rs.5000

Rate = 10% p.a

Time = 2 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=5000\left[\left(1+\frac{10}{100}\right)^{2}-1\right]$

$=5000\left[\left(\frac{11}{10}\right)^{2}-1\right]=5000\times\frac{21}{100}=Rs.1050$

Amount = Principal + compound interest

= 5000 + 1050 = Rs. 6050

(iv) Given,

Principal = Rs.2000

Rate = 4% p.a

Time = 3 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=2000\left[\left(1+\frac{4}{100}\right)^{3}-1\right]$

$=2000\left[\left(\frac{26}{25}\right)^{3}-1\right]=2000\times\frac{1951}{15625}=Rs.249.72$

Amount = Principal + compound interest

= 2000 + 249.72 = Rs.2249.73

(v) Given,

Principal = Rs.12800

Rate = $7\frac{1}{2}\% = \frac{15}{2}\%$

Time = 3 years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=12800\left[\left(1+\frac{15}{2\times100}\right)^{3}-1\right]$

$=12800\left[\left(\frac{43}{40}\right)^{3}-1\right]=12800\times\frac{15507}{64000}$ = Rs.3101.40

Amount = principal + compound interest

= 12800 + 3101.40 = Rs. 15901.40

(vi) Given,

Principal = Rs.10000

Rate = 20% p.a = $\frac{20}{2}=10\%\ quarterly$

Time = 2 years = 2×2 = 4 quarter

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=10000\left[\left(1+\frac{10}{100}\right)^{4}-1\right]$

$=100{}00\left[\left(\frac{11}{10}\right)^{4}-1\right]=10000\times\frac{4641}{10000}=Rs.4641$

Amount = Principal + Compound interest

= 10000 + 4641 = Rs.14641

(vii) Given,

Principal = Rs.160000

Rate = 10% p.a = $\frac{10}{2} = 5\%\ half\ yearly$

Time = 2 years = 2×2 = 4 quarters

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 160000\left[\left(1+\frac{5}{100}\right)^{4}-1\right]$

=160000$\left[\left(\frac{21}{20}\right)^{4}-1\right] = 160000\times\frac{34481}{160000} = Rs.34481$

Amount = principal + Compound interest

= 160000+34481 = Rs.194481

2. Question

Find the amount of Rs. 2400 after 3 years, when the interest is compounded annually at the rate of 20% per annum.

Answer

Given,

Principal = Rs.2400

Rate = 20% per annum

Time = 3 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 2400\left[\left(1+\frac{20}{100}\right)^{3}\right]$

$= 244\left[\left(\frac{6}{5}\right)^{3}-1\right] = 2400\times\frac{91}{125} = Rs.1747.20$

So,

Amount = principal + compound interest

= 2400 + 1747.20 = Rs.4147.20

3. Question

Rahman lent Rs. 16000 to Rasheed at the rate of $12\frac{1}{2}$% per annum compound interest. Find the amount payable by Rasheed to Rahman after 3 years.

Answer

Given,

Principal = Rs.16000

Rate = $12\frac{1}{2}\%$ per annum = $\frac{25}{2}\%$

Time = 3 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=16000\left[\left(1+\frac{25}{(2\times100)}\right)^{3}-1\right]$

$=16000\left[\left(\frac{9}{8}\right)^{3}-1\right]=16000\times\frac{217}{512}=Rs.6781.25$

So,

Amount payable by Rasheed to Rahman after 3 years = Rs(16000+6781.25) = Rs.22781.25

4. Question

Meera borrowed a sum of Rs. 1000 from Sita for two years. If the rate of interest is 10% compounded annually, find the amount that Meera has to pay back.

Answer

Given,

Principal = Rs.1000

Rate of interest = 10% p.a

Time = 2 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=1000\left[\left(1+\frac{10}{100}\right)^{2}-1\right]$

$=1000\left[\left(\frac{11}{10}\right)^{2}-1\right]=1000\times\frac{21}{100}=Rs.210$

So,

Amount that Meera has to pay back = Rs.(1000+210) = Rs.1210

5. Question

Find the difference between the compound interest and simple interest. On a sum of Rs. 50,000 at 10% per annum for 2 years.

Answer

Given,

Principal = Rs.50000

Rate = 10% per annum

Time = 2 years

Hence,

$= simple\ interest = \frac{P \times R \times T}{100} = \frac{50000 \times 10 \times 2}{100} = Rs.\ 10000$

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 50000\left[\left(1+\frac{10}{100}\right)^{2}-1\right]$

$= 50000\left[\left(\frac{11}{10}\right)^{2}-1\right] = 50000 \times \frac{21}{100} = Rs.\ 10500$

So,

Difference between compound interest and simple interest = Rs.(10500 – 10000) = Rs.500

6. Question

Amit borrowed Rs. 16000 at $17\frac{1}{2}$% per annum simple interest. On the same day, he lent it to Ashu at the same rate but compounded annually. What does he gain at the end of 2 years?

Answer

Given,

Principal = Rs.406

Rate = $12\frac{1}{2}$% per annum = $\frac{25}{4}$% semi annually

Time = 18 months = $\frac{18}{12} = 1\frac{1}{2} = \frac{3}{2} \times 2 = 3\ semi\ year$

Hence,

Amount = Principal = Rs.16000

Rate = $17\frac{1}{2}$ % = $\frac{35}{2}$ %

Time = 2 years

Hence ,

Interest paid by Amit on this sum = $\frac{P \times R \times T}{100} = \frac{16000 \times 35 \times 2}{100 \times 2} = Rs.\ 5600$

Interest that Amit get from Ashu = Compound interest = $16000[\left(1+\frac{35}{2 \times 100}\right)^{2}-1]$

$16000\left[\left(\frac{47}{40}\right)^{2}-1\right] = 16000 \times \frac{609}{1600}$

$= Rs.6090$

Hence,

Gain of Amit = Rs.(6090 – 5600) = Rs. 490

7. Question

Find the amount of Rs. 406 for 18 months at $12\frac{1}{2}$% per annum, the interest being compounded semi-annually.

Answer

Given,

Principal = Rs.406

Time = 18 Months = $\frac{18}{12} = 1\frac{1}{2} = \frac{3}{2} \times 2 = 3\ half\ years$

Rate = $12\frac{1}{2}$ % per annum = $\frac{25}{4}\ \%\ half\ yearly$

So,

$= 406\left[\left(1+\frac{25}{4\times100}\right)^3\right] = 406\left(\frac{17}{16}\right)^3 = \frac{406\times4913}{4096} = Rs.486.98$

Amount = Rs.486.98

8. Question

Find the amount and the compound interest on Rs. 8000 for $1\frac{1}{2}$years at 10% per annum, compounded half-yearly.

Answer

Given,

Principal = Rs.8000

Time = 1-$\frac{1}{2}$ years = $\frac{3}{2} \times 2 = 3\ half\ years$

Rate = 10% per annum = $\frac{10}{2} = 5\%\ half\ yearly$

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^T - 1\right] = 8000\left[\left(1+\frac{5}{100}\right)^3 - 1\right]$

$= 8000\left[\left(\frac{21}{20}\right)^3 - 1\right] = 8000\times\frac{1261}{8000} = Rs.1261$

Amount = Principal + compound interest

= 8000+1261 = Rs.9261

9. Question

Kamal borrowed Rs. 57600 from LIC against her policy at $12\frac{1}{2}$% per annum to build a house. Find the amount that she pays to the LIC after $1\frac{1}{2}$years if the interest is calculated half-yearly.

Answer

Given,

Principal = Rs.57600

Rate = 12-$\frac{1}{2}$% per annum = $\frac{25}{4}\%\ haf\ yearly$

Time = $1\frac{1}{2}$ years = $\frac{3}{2}\times 2 = 3\ half\ years$

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 57600\left[\left(1+\frac{25}{4\times 100}\right)^{3}-1\right]$

= $57600\left[\left(\frac{17}{16}\right)^{3}-1\right] = 57600\times\frac{817}{4096} = Rs.\ 11489.06$

So,

Amount that Kamal pays to LIC after 1-$\frac{1}{2}$ years = Rs.(57600 + 11489.06) = Rs.69089.06

10. Question

Abha purchased a house from Avas Parishad on credit. If the cost of the house is Rs. 64000 and the rate of interest is 5% per annum compounded half-yearly, find the interest paid by Abha after one year and a half.

Answer

Given,

Principal = Rs.64000

Rate of interest = 5% per annum = $\frac{5}{2}$% half yearly

Time = 1-$\frac{`1}{2}$years = $\frac{3}{2}\times 2 = 3\ half\ years$

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right] = 64000\left[\left(1+\frac{5}{2\times 100}\right)^{3}-1\right]$

= $64000\left[\left(\frac{41}{40}\right)^{3}-1\right]$ = $64000\times\frac{4921}{64000} = Rs.\ 4921$

So, interest paid by Abha = Rs.4921

11. Question

Rakesh lent out Rs. 10000 for 2 years at 20% per annum, compounded annually. How much more he could earn if the interest be compounded half-yearly?

Answer

Given,

Principal = Rs.10000

Rate = 20%

Time = 2 year

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=10000\left[\left(1+\frac{20}{100}\right)^{2}-1\right]$

$=10000\left[\left(\frac{6}{5}\right)^{2}-1\right]=10000\times\left(\frac{11}{25}\right)=Rs.4400$

If interest compounded half yearly ,

Rate = $\frac{20}{2}=10\%$

Time = 2×2 = 4 half years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=10000[(1+\left(\frac{10}{100}\right)^{4}-1]$

$=10000\left[\left(\frac{11}{10}\right)^{4}-1\right]=10000\times\frac{4641}{10000}=Rs.4641$

So,

If Rakesh can earn = Rs.(4641 – 4400) = Rs.241 more

12. Question

Romesh borrowed a sum of Rs. 245760 at 12.5% per annum, compounded annually. On the same day, he lent out his money to Ramu at the same rate of interest, but compounded semi-annually. Find his gain after 2 years.

Answer

Given,

For Romesh,

Principal = Rs. 245760

Rate = 12.5% per annum

Time = 2 years

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=245760\left[\left(1+\frac{125}{1000}\right)^{2}-1\right]$

$=245760\left[\left(\frac{45}{40}\right)^{2}-1\right]=245760\times\frac{425}{1600}=Rs.65280$

For Ramu,

Principal = Rs.245760

Rate = $\frac{12.5}{2}=6.25\%$

Time = 2×2 = 4 half years

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=245760\left[\left(1+\frac{625}{10000}\right)^{4}-1\right]$

$=245760\left[\left(\frac{17}{16}\right)^{4}-1\right]=245760\times\frac{17985}{65536}=Rs.67443.75$

Hence,

Gain for Romesh = Rs.(67443.75 – 65280) = Rs. 2163.75

13. Question

Find the amount that David would receive if he invests Rs. 8192 for 18 months at 12_c% per annum, the interest being compounded half-yearly.

Answer

Given,

Principal = Rs.8192

Rate = 12% p.a = $\frac{12}{2}=6\%\ half\ yearly$

Time = 18 months = $\frac{18}{12}=1\frac{1}{2}$ years = $3\ half\ years$

Hence,

Amount = $P\left[\left(1+\frac{R}{100}\right)^{time}\right]=8192\left[\left(1+\frac{6}{100}\right)^{3}\right]=8192\times\left(\frac{53}{50}\right)^{3}$

$=8192\times\frac{53}{50}\times\frac{53}{50}\times\frac{53}{50}=Rs.9826$

So,

David receives Rs.9826 after 18 months

14. Question

Find the compound interest on Rs. 15625 for 9 months, at 16% per annum, compounded quarterly.

Answer

Given,

Principal = Rs. 15625

Rate = 16% per annum = $\frac{16}{4} = 4\%\ quarterly$

Time = 9 months = $\frac{9}{12}\ years = \frac{9}{12} \times 4 = 3\ quarters$

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^T - 1\right] = 15625\left[\left(1+\frac{4}{100}\right)^3 - 1\right]$

$= 15625\left[\left(\frac{26}{25}\right)^3 - 1\right] = 15625 \times \frac{1951}{15625} = Rs.1951$

15. Question

Rekha deposited Rs. 16000 in a foreign bank which pays interest at the rate of 20% per annum compounded wuarterly, find the interest received by Rekha after one year

Answer

Given,

Principal = Rs. 16000

Rate = 20% per annum = $\frac{20}{4} = 5\%\ quarterly$

Time = 1 year = 4 quarters

Hence,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^T - 1\right] = 16000\left[\left(1+\frac{5}{100}\right)^4 - 1\right]$

$= 16000\left[\left(\frac{21}{20}\right)^4 - 1\right] = 16000 \times \frac{34481}{160000} = Rs.3448.10$

So,

Interest received by Rekha after one year = Rs.3448.10

16. Question

Find the amount of Rs. 12500 for 2 years compounded annually, the rate of interest being 15% for the first year and 16% for the second year.

Answer

Given,

Principal = Rs.12500

Time = 2 years

$= R_1$ = 15%

= R_2 = 16%

Hence,

Amount = $P\left[\left(1+\frac{R_1}{100}\right)\right]\left[\left(1+\frac{R_2}{100}\right)\right] = 12500\left[1+\frac{15}{100}\right]\left[1+\frac{16}{100}\right]$

= $12500\times\frac{23}{20}\times\frac{29}{25} = Rs.16675$

17. Question

Ramu borrowed Rs. 15625 from a finance company to buy scooter. If the rate of interest be 16% per annum compounded annually, what payment will he have to make after $2\frac{1}{4}$ years?

Answer

Given,

Principal = Rs.15625

Rate = 16% per annum

Time = 2-$\frac{1}{4}$ years

Amount = $P\left[\left(1+\frac{R}{100}\right)^2\right]\left[\left(1+\frac{\frac{R}{4}}{100}\right)\right] = 15625\left[\left(1+\frac{16}{100}\right)^2\right]\left[\left(1+\frac{4}{100}\right)\right]$

= $15625\ \frac{29}{25}\times\frac{29}{25}\times\frac{26}{25} = Rs.21866$

So,

Ramu has to make a payment of Rs.21866

18. Question

What will Rs. 125000 amount to at the rate of 6%, if the interest is calculated after every four months?

Answer

Principal = Rs. 125000

Time = 1 year

Rate = 6% per annum

∵ Interest is compounded after 4 months, So Rate of interest will be counted as 6/3 = 2% and time will be 12/4 = 3

We know that, $A = P\times\left(1+\frac{R}{100}\right)^t$

$\Rightarrow A = 125000\times\left(1+\frac{2}{100}\right)^3$

$$\Rightarrow A = 125000 \times \left(\frac{102}{100}\right)^3 = Rs.132651$$

19. Question

Find the compound interest at the rate of 5% for three years on that principal which in three years at the rate of 5% per annum gives Rs. 12000 as simple interest.

Answer

Given,

Simple interest = Rs.12000

Rate = 5% per annum

Time = 3 years

So,

$= simple\ interest = \frac{P \times R \times T}{100} = \frac{P \times 5 \times 3}{100} = 12000$

$= P = \frac{12000 \times 100}{15} = Rs.80000$

We get ,

Principal = Rs.80000

Rate = 5% per annum

Time = 3 years

Compound interest = $P\left[\left(1 + \frac{R}{100}\right)^T - 1\right] = 80000\left[\left(1 + \frac{5}{100}\right)^3 - 1\right]$

$= 80000\left[\left\{\frac{21}{20}\right\}^3 - 1\right] = 80000 \times \frac{1261}{8000} = Rs.12610$

20. Question

A sum of money was lent for 2 years at 20% compounded annually. If the interest is payable half-yearly instead of yearly, then the interest is Rs. 482 more. Find the sum.

Answer

Given,

Rate of interest = 20% p.a = $\frac{20}{2} = 10\%\ half\ yearly$

Time = 2 years = $2 \times 2 = 4\ half\ years$

Let principal = Rs. P

According to the question,

$= P \times \frac{4641}{10000} - P \times \frac{11}{25} = 482$

$= \frac{4641P-4400P}{10000} = 482$

$= P = \frac{482\times10000}{241} = 20000$

Hence,

Principal = Rs.20000

21. Question

Simple interest on a sum of money for 2 years at $6\frac{1}{2}\%$ per annum is Rs. 5200. What will be the compound interest on the sum at the same rate for the same period.

Answer

S.I = Rs.5200

Rate of simple interest = $6\frac{1}{2}\% = \frac{13}{2}\%$

time = 2 years

Let principal = Rs. P

so, by formula

$= Simple\ interest = \frac{P\times R\times T}{100} = \frac{P\times13\times2}{2\times100} = 5200$

$= P = \frac{5200\times200}{13\times2} = Rs.40000$

Hence,

Principal = Rs. 40000

now,

Rate of compound interest = $6\frac{1}{2}\% = \frac{13}{2}\%$

Time = 2 years

so,

compound interest = $40000\left[\left(1+\frac{13}{2\times100}\right)^2-1\right]$

compound interest $= 40000\left[\left(\frac{213}{200}\right)^2-1\right]$

compound interest = 45369 – 40000 = Rs.5369

22. Question

What will be the compound interest at the rate of 5% per annum for 3 years on that principal which in 3 years at the rate of 5% per annum gives Rs. 1200 as simple interest,

Answer

Given,

S.I = Rs.1200

Rate of simple interest = 5%

time = 3 years

Let principal = Rs. P

so, by formula

$= Simple\ interest = \frac{P \times R \times T}{100} = \frac{P \times 3 \times 5}{100} = 1200$

$= P = \frac{1200 \times 100}{3 \times 5} = 8000$

Hence,

Principal = Rs.8000

now,

Rate of compound interest = 5%

Time = 3 years

so,

compound interest = $8000\left[\left(1+\frac{5}{100}\right)^3 - 1\right] = 8000\left[\left(\frac{21}{20}\right)^3 - 1\right] = 8000 \times \frac{1261}{8000} = Rs.\ 1261$

Exercise 14.3

1. Question

On what sum will the compound interest at 5% per annum for 2 years compounded annually be Rs 164?

Answer

Given,

Rate of interest= 5% p.a

Time = 2 years

Compound interest = Rs.164

Let principal = P

By applying formula ,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^T - 1\right]$

$= P\left[\left(1+\frac{5}{100}\right)^2-1\right]=164$

$= P\left[\left(\frac{21}{20}\right)^2-1\right]=164$

$= P\times\frac{41}{400}=164$

$= P=\frac{164\times400}{41}=Rs.1600$

Hence,

Principal = Rs. 1600.

2. Question

Find the principal if the interest compounded annually at the rate of 10% for two years is Rs. 210.

Answer

Given,

Rate = 10% p.a

Time = 2 years

Compound interest = Rs.210

Let principal = P

So,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^T-1\right]$

$= P\left[\left(1+\frac{10}{100}\right)^2-1\right]=210$

$= P\left[\left(\frac{11}{10}\right)^2-1\right]=210$

$= P\times\frac{21}{100}=210$

$= P=\frac{210\times100}{21}=Rs.1000$

Hence,

Principal = Rs.1000.

3. Question

A sum amounts to Rs. 756.25 at 10% per annum in 2 years, compounded annually. Find the sum .

Answer

Given,

Amount = Rs.756.25

Rate = 10% p.a

Time = 2 years

Let principal = P

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $P\left[\left(1+\frac{10}{100}\right)^{2}\right]=756.25$

= P$\times\frac{121}{100}=756.25$

= $P=\frac{756.25\times100}{121}=Rs.625$

Hence,

Principal = Rs.625

4. Question

What sum will amount to Rs. 4913 in 18 months, if the rate of interest is $12\frac{1}{2}$% per annum, compounded half-yearly?

Answer

Given,

Amount = Rs.4913

Time = 18 months = $\frac{18}{12}years=\frac{3}{2}\times2=3\ half\ years$

Rate = 12-$\frac{1}{2}$% = $\frac{25}{2}\%=\frac{25}{4}\%\ half\ yearly$

Let principal = P

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= P[$\left(1+\frac{25}{4\times100}\right)^{3}=4913$

= $P\left[\left(\frac{17}{16}\right)^{3}\right]=4913$

= $P\times\frac{4913}{4096}=4913$

$= P = \frac{4913 \times 4096}{4913} = Rs.4096$

Hence ,

Principal = Rs. 4096

5. Question

The difference between the compound interest and simple interest on a certain sum at 15% per annum for 3 years is Rs. 283.50. Find the sum.

Answer

Given,

Rate = 15 % p.a

Time = 3 years

C.I – S.I = Rs.283.50

Let principal = P

So,

$= P\left[\left(1+\frac{15}{100}\right)^3 - 1\right] - \frac{P \times 15 \times 3}{100} = 283.50$

$= P\left[\left(\frac{23}{20}\right)^3 - 1\right] - \frac{9P}{20} = 283.50$

$= \frac{(4167P - 3600P)}{800} = 283.50$

$= 567P = 283.50 \times 800$

$= P = \frac{283.50 \times 800}{567} = Rs.4000$

Hence,

Principal = Rs. 4000

6. Question

Rachna borrowed a certain sum at the rate of 15% per annum. If she paid at the end of two years Rs. 1290 as interest compounded annually, find the sum she borrowed.

Answer

Given,

Rate = 15% p.a

Time = 2 years

C.I = Rs. 1290

Let principal = P

So,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

= $P\left[\left(1+\frac{15}{100}\right)^{2}-1\right]=1290$

= $P\left[\left(\frac{23}{20}\right)^{2}-1\right]=1290$

= $P\times\frac{129}{400}=1290$

= $P=\frac{1290\times400}{129}=Rs.4000$

Hence,

Principal = Rs. 4000

7. Question

The interest on a sum of Rs. 2000 is being compounded annually at the rate of 4% per annum. Find the period for which the compound interest is Rs. 163.20.

Answer

Given,

Principal = Rs. 2000

Rate = 4 % p.a

C.I = Rs.163.20

Let time = T years

So,

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

= $2000\left[\left(1+\frac{4}{100}\right)^{T}-1\right]=163.20$

= $2000\times\left(\frac{26}{25}\right)^{T}-2000=163.20$

= $2000\times\left(\frac{26}{25}\right)^{T}=2163.20$

= $\left(\frac{26}{25}\right)^{T}=\frac{2163.20}{2000}=\frac{676}{625}$

= $\left(\frac{26}{25}\right)^{T}=\left(\frac{26}{25}\right)^{2}$

= T = 2years

Hence,

Time = 2 years

8. Question

In how much time would Rs. 5000 amount to Rs. 6655 at 10% per annum compound interest?

Answer

Given,

Principal = Rs.5000

Rate = 10%

Amount = Rs.6655

Let time = T years

So,

$A = P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

$= 5000\left[\left(1+\frac{10}{100}\right)^{T}\right] = 6655$

$= \left(\frac{11}{10}\right)^{T} = \frac{6655}{5000} = \frac{1331}{1000}$

$= \left(\frac{11}{10}\right)^{T} = \left(\frac{11}{10}\right)^{3}$

= T= 3 years

Hence,

Time = 3 years.

9. Question

In what time will Rs. 4400 become Rs. 4576 at 8% per annum interest compounded half-yearly?

Answer

Given,

Principal = Rs. 4400

Amount = Rs.4576

Rate = 8% p.a = $\frac{8}{2} = 4\ \%\ half\ yearly$

Let time = T years = 2T half years

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $4400\left[\left(1+\frac{4}{100}\right)^{2T}\right]=4576$

= $\left(\frac{26}{25}\right)^{2T}=\frac{4576}{4400}=\frac{26}{25}$

= 2T = 1

= $T=\frac{1}{2}\ years$

Hence,

Time = $\frac{1}{2}\ years$

10. Question

The difference between the S.I. and C.I. on a certain sum of money for 2 years at 4$ per annum is Rs. 20. Find the sum.

Answer

Given,

Rate = 4%

Time = 2 years

C.I – S.I = Rs.20

Let principal = P

So,

=$P\left[\left(1+\frac{4}{100}\right)^{2}-1\right]-\frac{P\times4\times2}{100}=20$

= $\frac{51P}{625}-\frac{2P}{25}=20$

= $\frac{51P-50P}{625}=20$

= $P=20\times625\ =Rs.12500$

Hence,

Principal = Rs. 12500

11. Question

In what time will Rs. 1000 amount to Rs. 1331 at 10% per annum, compound interest?

Answer

Given,

Principal = Rs.1000

Amount = Rs. 1331

Rate = 10% p.a

Let time = T years

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $1000\left[\left(1+\frac{10}{100}\right)^{T}\right]=\ 1331$

= $\left(\frac{11}{10}\right)^{T}=\frac{1331}{1000}=\left(\frac{11}{10}\right)^{3}$

= T = 3 years

Hence,

Time = 3 years

12. Question

At what rate percent compound interest per annum will Rs. 640 amount to Rs. 774.40 in 2 years?

Answer

Given,

Principal = Rs.640

Amount = Rs.774.40

Time = 2 years

Let rate = R%

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $640\left[\left(1+\frac{R}{100}\right)^{2}\right]=\ 774.40$

= $\left(1+\frac{R}{100}\right)^{2}=\frac{774.40}{640}=\frac{484}{400}=\left(\frac{22}{20}\right)^{2}$

= $1+\frac{R}{100}=\frac{22}{20}$

= $\frac{R}{100}=\frac{22}{20}-1=\frac{2}{20}$

= $R=\frac{2\times100}{20}=10\%\ per\ annum$

Hence,

Rate = 10% per annum

13. Question

Find the rate percent per annum if Rs. 2000 amount to Rs. 2662 in $1\frac{1}{2}$years, interest being compounded half-yearly?

Answer

Given,

Principal = Rs.2000

Amount = Rs.2662

Time = 1-$\frac{1}{2}$ years = $\frac{3}{2}\times 2 = 3\ half\ years$

Let rate = R% per annum , $\frac{R}{2}\ \%\ half\ yearly$

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $2000\left[\left(1+\frac{R}{2\times 100}\right)^{3}\right] = 2662$

= $\left(1+\frac{R}{200}\right)^{3} = \frac{2662}{2000} = \frac{1331}{1000} = \left(\frac{11}{10}\right)^{3}$

= $1+\frac{R}{200} = \frac{11}{10}$

= $\frac{R}{200} = \frac{11}{10} - 1 = \frac{1}{10}$

= $R = \frac{1\times 200}{10} = 20\%\ per\ annum$

Hence ,

Rate = 20% per annum

14. Question

Kamala borrowed from Ratan a certain sum at a certain rate for two years simple interest. She lent this sum at the same rate to Harti for two years compound interest. At the end of two years she received Rs. 210 as compound interest, but paid Rs. 200 only as simple interest. Find the sum and the rate of interest.

Answer

Given,

C.I that Kamla receive = Rs.210

S.I that Kamla paid = Rs.200

Time = 2 years

So,

S.I = $\frac{P\times R\times T}{100} = \frac{(P\times R\times 2)}{100} = 200$

$P\times R = 10000 \ldots\ldots\ldots\ldots\ldots\ldots (i)$Also,

C.I. = Total amount - Principal amount

C.I = $P\left(1+\frac{R}{100}\right)^{T} - P$

210 = $P\left(1+\frac{R}{100}\right)^{2} - P$

we know, $(a + b)^2 = a^2 + b^2 + 2ab$

$$210 = P\left(1^2 + \frac{R^2}{100^2} + 2(1)\left(\frac{R}{100}\right)\right) - P$$
$$210 = P\left(1 + \frac{R^2}{10000} + \frac{R}{50}\right) - P$$
$$210 = P\left(1 + \frac{R}{10000} + \frac{R}{50} - 1\right)$$
$$210 = P\left(\frac{R^2}{10000} + \frac{R}{50}\right)$$
$$210 = \frac{PR^2}{10000} + \frac{PR}{50}$$

From (i), we have PR = 10000

$$\therefore 210 = \frac{10000R}{10000} + \frac{10000}{50}$$
$$210 = R + 200$$

R = 10%

From equation (i)

$P\times R = 10000$

P × R = 10000$P = \frac{10000}{10} = Rs.1000$

15. Question

Find the rate percent per annum, if Rs. 2000 amount to Rs. 2315.25 in an year and a half, interest being compounded six monthly.

Answer

Given,

Principal = Rs.2000

Amount = Rs.2315.25

Time = $1\frac{1}{2}$ years = $\frac{3}{2} years$

Let rate = R % per annum

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $2000\left[\left(1+\frac{R}{100}\right)^{\frac{3}{2}}\right] = 2315.25$

= $\left(1+\frac{R}{100}\right)^{\frac{3}{2}} = 1.1576$

= $1+\frac{R}{100} = 1.1025$

= $\frac{R}{100} = 0.1025$

= $R = 10.25\ \%$

Hence ,

Rate = 10.25%

16. Question

Find the rate at which a sum of money will double itself in 3 years, if the interest is compounded annually.

Answer

Given,

Time = 3 years

Let rate = R %

Let principal = P

So, amount becomes = 2P

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $P\left(1+\frac{R}{100}\right)^{3} = 2P$

= $1+\frac{R}{100} = 2^{\frac{1}{3}} = 1.2599$

$= \frac{R}{100} = 1.2599 - 1 = 0.2599$

Rate = 25.99%

17. Question

Find the rate at which a sum of money will become four times the original amount in 2 years, if the interest is compounded half-yearly.

Answer

Given,

Time = 2 years = 2×2 = 4 half years

Let rate = R % per annum = $\frac{R}{2}\ \%\ half\ yearly$

Let principal = P

Amount becomes = 4P

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

$= P[\left(1+\frac{R}{2\times100}\right)^{4} = 4P$

$= 1+\frac{R}{200} = 4^{\frac{1}{4}} = 1.4142$

$= \frac{R}{200} = 1.4142 - 1 = 0.4142$

$= R = 0.4142\times200 = 82.84\%$

Hence ,

Rate = 82.84 %

18. Question

A certain sum amounts to Rs. 5832 in 2 years at 8% compounded interest. Find the sum.

Answer

Given,

Amount = Rs.5832

Time = 2 years

Rate = 8%

Let principal = P

So,

A = $P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

= $P\left[\left(1+\frac{8}{100}\right)^{2}\right]=5832$

= $P\times\frac{27}{25}\times\frac{27}{25}=5832$

= $P=\frac{5832\times25\times25}{27\times27}=Rs.5000$

Hence,

Principal = Rs.5000

19. Question

The difference between the compound interest and simple interest on a certain sum for 2 years at 7.5% per annum is Rs. 360. Find the sum.

Answer

Given,

C.I – S.I = Rs.360

Time = 2 years

Rate = 7.5 % per annum

Let principal = Rs. P

So,

= $P\left[\left(1+\frac{7.5}{100}\right)^{2}-1\right]-\frac{P\times7.5\times2}{100}=360$

= $P\times\frac{249}{1600}-\frac{3P}{20}=360$

= $\frac{249P-240P}{1600}=360$

= $9P=360\times1600$

= $P=\frac{360\times1600}{9}=Rs.64000$

Hence,

Principal = Rs. 64000

20. Question

The difference in simple interest and compound interest on a certain sum of money at $6\frac{2}{3}$% per annum for 3 years in Rs. 46. Determine the sum.

Answer

Given,

S.I – C.I = Rs. 46

Rate = $6\frac{2}{3}$ %= $\frac{20}{3}\%\ per\ annum$

Time = 3 years

Let principal = Rs. P

So,

$= \frac{P\times3\times20}{3\times100} - P\left[\left(1+\frac{20}{300}\right)^3 - 1\right] = 46$

$= \frac{P}{5} - \frac{721P}{3375} = 46$

$= \frac{675P-721P}{3375} = 46$

= P = $\frac{3375\times46}{46} = Rs.3375$

Hence,

Principal = Rs. 3375

21. Question

Ishita invested a sum of Rs. 12000 at 5% per annum compound interest. She received an amount of Rs. 13230 after *n* years. Find the value of *n.*

Answer

Given,

Principal = Rs.12000

Rate = 5% per annum

Amount = Rs.13230

Let time = T years

So,

A = $P\left[\left(1+\frac{R}{100}\right)^T\right]$

$= 12000\left[\left(1+\frac{5}{100}\right)^T\right] = 13230$

$= \left(\frac{21}{20}\right)^T = \frac{13230}{12000} = \frac{441}{400} = \left(\frac{21}{20}\right)^2$

= T= 2 years

Hence ,

Time = 2 years

22. Question

At what rate percent per annum will a sum of Rs. 4000 yield compound interest of Rs. 410 in 2 years?

Answer

Given,

Principal = Rs.4000

C.I = Rs.410

Time = 2 years

Let rate of interest = R %

So,

$= compound\ interest = P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 4000\left[\left(1+\frac{R}{100}\right)^{2}-1\right] = 410$

$= 4000\left(1+\frac{R}{100}\right)^{2}-4000 = 410$

$= 4000\left(1+\frac{R}{100}\right)^{2} = 4000+410 = 4410$

$= \left(1+\frac{R}{100}\right)^{2} = \frac{4410}{4000} = \frac{441}{400} = \left(\frac{21}{20}\right)^{2}$

$= 1+\frac{R}{100} = \frac{21}{20}$

$= \frac{R}{100} = \frac{21}{20} - 1 = \frac{1}{20}$

$= R = \frac{1\times100}{20} = 5\ \%$

Hence,

Rate of interest = 5% per annum

23. Question

A sum of money deposited at 2% per annum compounded annually becomes Rs. 10404 at the end of 2 years. Find the sum deposited.

Answer

Given,

Rate of interest = 2% p.a

Time = 2 years

Amount = Rs.10404

Let principal = Rs. P

So,

$A = P\left[\left(1+\frac{R}{100}\right)^T\right]$

$= P\left[\left(1+\frac{2}{100}\right)^2\right] = 10404$

$= P\times\frac{51}{50}\times\frac{51}{50} = 10404$

$= P = \frac{10404\times50\times50}{51\times51} = Rs.10000$

Hence,

Principal = Rs.10000

24. Question

In how much time will a sum of Rs. 1600 amount to Rs. 1852.20 at 5% per annum compound interest?

Answer

Given,

Principal = Rs.1600

Amount = Rs.1852.20

Rate = 5 % per annum

Let time = T years

So,

$A = P\left[\left(1+\frac{R}{100}\right)^T\right]$

$= 1600\left(1+\frac{5}{100}\right)^T = 1852.20$

$= \left(\frac{21}{20}\right)^T = \frac{1852.20}{1600} = \frac{9261}{8000} = \left(\frac{21}{20}\right)^3$

= T = 3 years

Hence,

Time = 3 years

25. Question

At what rate percent will a sum of Rs. 1000 amount to Rs. 1102.50 in 2 years at compound interest?

Answer

Given,

Principal = Rs.1000

Amount = Rs.1102.50

Time = 2 years

Let rate of interest = R % per annum

So,

$A = P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

$= 1000\left(1+\frac{R}{100}\right)^{2} = 1102.50$

$= \left(1+\frac{R}{100}\right)^{2} = \frac{1102.50}{1000} = \frac{4410}{4000} = \left(\frac{21}{20}\right)^{2}$

$= 1+\frac{R}{100} = \frac{21}{20}$

$= \frac{R}{100} = \frac{21}{20} - 1 = \frac{1}{20}$

$= R = \frac{1}{20}\times 100 = 5\%$

Hence,

Rate of interest = 5 % per annum

26. Question

The compound interest on Rs. 1800 at 10% per annum for a certain period of timeos Rs. 378. Find the time in years.

Answer

Given,

Compound interest = Rs.375

Principal = Rs.1800

Rate = 10% p.a

Let time = T years

So,

$= compound\ interest = P\left[\left(1+\frac{R}{100}\right)^{T} - 1\right]$

$= 1800\left[\left(1+\frac{10}{100}\right)^{T} - 1\right] = 378$

$= 1800 \times \left(\frac{11}{10}\right)^T - 1800 = 378$

$= 1800 \times \left(\frac{11}{10}\right)^T = 378 + 1800 = 2178$

$= = \left(\frac{11}{10}\right)^T = \frac{2178}{1800} = \frac{726}{600} = \frac{121}{100} = \left(\frac{11}{10}\right)^2$

$= T = 2\ years$

Hence.

Time = 2 years

27. Question

What sum of money will amount to Rs. 45582.25 at $6\frac{3}{4}$% per annum in two years, interest being compounded annually?

Answer

Given,

Amount = Rs.45582.25

Rate = $6\frac{3}{4}$ % = $\frac{27}{4}\%\ p.a$

Time = 2 years

Let principal = Rs.P

So,

A = $P\left[\left(1 + \frac{R}{100}\right)^T\right]$

$= P\left[\left(1 + \frac{27}{4 \times 100}\right)^2\right] = 45582.25$

$= P \times \frac{427}{400} \times \frac{427}{400} = 45582.25$

$= P = \frac{45582.25 \times 400 \times 400}{427 \times 427} = Rs.40000$

Hence,

Principal = Rs. 40000

28. Question

Sum of money amounts to Rs. 453690 in 2 years at 6.5% per annum compounded annually. Find the sum.

Answer

Given,

Amount = Rs.453690

Time = 2 years

Rate = 6.5 % p.a

Let principal = Rs. P

So,

$A = P\left[\left(1+\frac{R}{100}\right)^{T}\right]$

$= P\left[\left(1+\frac{6.5}{100}\right)^{2}\right] = 453690$

$= P\times\frac{213}{200}\times\frac{213}{200} = 453690$

$= P = \frac{453690\times200\times200}{213\times213} = Rs.400000$

Hence ,

Principal = Rs. 400000

Exercise 14.4

1. Question

The present population of a town is 28000. If it increases at the rate of 5% per annum, what will be its population after 2 years?

Answer

Given,

Present population of town = 28000

Rate of increase = 5% per annum

Hence,

Population of town after 2 years = $28000[\left(1+\frac{5}{100}\right)^{2} = 28000\times\frac{21}{20}\times\frac{21}{20} = 30870.$

2. Question

The population of a city is 125000. If the annual birth rate and death rate are 5.5% and 3.5% respectively, calculate the population of city after 3 years.

Answer

Given,

Population of city = 125000

Annual birth rate = 5.5 %

Annual death rate = 3.5 %

Annual increasing rate = 5.5 – 3.5 = 2 %

Hence,

Population of city after 3 years = $125000\left[\left(1+\frac{2}{100}\right)^3\right] = 125000\times\frac{51}{50}\times\frac{51}{50}\times\frac{51}{50} = 132651$

3. Question

The present population of a town is 25000. It grows at 4%, 5% and 8% during first year, second year and third year respectively. Find its population after 3 years.

Answer

Given,

Present population of town = 25000

Growth rate in 3 years = 4% , 5% ,8% respectively

Hence,

Population of town after 3 years = $25000\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{8}{100}\right)$

$= 25000\times\frac{26}{25}\times\frac{21}{20}\times\frac{27}{25} = 29484.$

4. Question

Three years ago, the population of a town was 50000. If the annual increase during three successive years be at the rate of 4%, 5% and 3% respectively, find the present population.

Answer

Given,

Population of town 3 years ago was = 50000

Annual increasing in 3 years = 4% ,5%, 3% respectively

Let present population = X

So,

$= 50000\left(1+\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{3}{100}\right) = X$

$= 50000\times\frac{26}{25}\times\frac{21}{20}\times\frac{103}{100} = X$

$= X = 56238$

Hence,

Present population of town = 56238

5. Question

There is a continuous growth in population of a village at the rate of 5% per annum. If its present population is 9261, what it was 3 years ago?

Answer

Given,

Present population of village = 9261

Continuous growth rate = 5%

Let 3 years ago population of village was = X

So,

$= X\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right) = 9261$

$= X\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = 9261$

$= X = \frac{9261\times8000}{9261} = 8000$

Hence,

3 years ago population of village was = 8000

6. Question

In a factory the production of scooters rose to 46305 from 40000 in 3 years. Find the annual rate of growth of the production of scooters.

Answer

Given,

Initial production of scooters = 40000

Final production of scooters = 46305

Time duration = 3 years

Let annual growth rate = R%

So,

$= 40000\left(1+\frac{R}{100}\right)\left(1+\frac{R}{100}\right)\left(1+\frac{R}{100}\right) = 46305$

$= \left(1+\frac{R}{100}\right)^3 = \frac{46305}{40000} = \frac{9261}{8000} = \left(\frac{21}{20}\right)^3$

$= 1+\frac{R}{100} = \frac{21}{20}$

$= \frac{R}{100} = \frac{21}{20} - 1 = \frac{1}{20}$

$= R = \frac{1}{20}\times100 = 5\%$

Hence,

Annual growth rate of production of scooters = 5 %

7. Question

The annual rate of growth in population of a certain city is 8%. If its present population is 196830, what it was 3 years ago?

Answer

Given,

Annual growth rate of population of city = 8%

Present population of city = 196830

Let population of city 3 years ago was = X

So,

$$= X\left(1+\frac{8}{100}\right)\left(1+\frac{8}{100}\right)\left(1+\frac{8}{100}\right) = 196830$$

$$= X\times\frac{27}{25}\times\frac{27}{25}\times\frac{27}{25} = 196830$$

$$= X = \frac{196830\times25\times25\times25}{27\times27\times27} = 156250$$

Hence,

Population of city 3 years ago was = 156250.

8. Question

The population of a town increases at the rate of 50 per thousand. Its population after 2 years will be 22050. Find its present population.

Answer

Given,

Growth rate of population of town = $\frac{50}{1000}\times100 = 5\%$

Population after 2 years = 22050

Let present population of town = X

So,

$$= X\times\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right) = 22050$$

$$= X\times\frac{21}{20}\times\frac{21}{20} = 22050$$

$$= X = \frac{22050\times20\times20}{441} = 20000$$

Hence,

Present population of town = 20000

9. Question

The count of bacteria in a culture grows by 10% in the first hour, decreases by 8% in the second hour and again increases by 12% in the third hour. If the count of bacteria in the sample is 13125000, what will be the count of bacteria after 3 hours?

Answer

Given,

Count of bacteria in sample = 13125000

According to increase and decrease of growth rates,

Let count of bacteria after 3 hours = X

So,

$$= 13125000\left(1+\frac{10}{100}\right)\left(1-\frac{8}{100}\right)\left(1+\frac{12}{100}\right) = X$$

$$= 13125000\times\frac{11}{10}\times\frac{23}{25}\times\frac{28}{25} = X$$

$$= X = \frac{13125000\times10\times25\times25}{11\times23\times28} = 14876400$$

Hence,

Count of bacteria after 3 hours will be = 14876400

10. Question

The population of a certain city was 72000 on the last day of the year 1998. During next year it increased by 7% but due to an epidemic it decreased by 10% in the following year. What was its population at the end of the year 2000?

Answer

Given,

Population of city on last day of year 1998 = 72000

Increasing rate in 1999 = 7%

Decreasing rate in 2000 = 10 %

So,

Population at the end of 2000 = $72000\times\left(1+\frac{7}{100}\right)\left(1-\frac{10}{100}\right) = 72000\times\frac{107}{100}\times\frac{9}{10} = 69336.$

11. Question

6400 workers were employed to construct a river bridge in four years. At the end of the first year, 25% workers were retrenched. At the end of the second year, 25% of those working at that time were retrenched. However, to complete the project in time, the number of workers was increased by 25% at the end of the third year. How many workers were working during the fourth year?

Answer

Given,

Intial number of workers = 6400

At the end of first year = 25% retrenched

At the end of second year = 25% retrenched

At the end of third year = 25% increased

So,

Number of workers working during fourth year = $6400\left(1-\frac{25}{100}\right)\left(1-\frac{25}{100}\right)\left(1+\frac{25}{100}\right)$

$= 6400\times\frac{3}{4}\times\frac{3}{4}\times\frac{5}{4} = 4500\ workers$

12. Question

Aman started a factory with an initial investment of Rs. 100000. In the first year, he incurred a loss of 5%. However, during the second year, he earned a profit of 10% which in the third year rose to 12%. Calculate his net profit for the entire period of three years.

Answer

Given,

Initial investment by Aman = Rs.100000

In first year = loss of 5%

In second year = profit of 10%

In third year = profit of 12 %

So,

His net profit for entire period of three years = $100000\left(1-\frac{5}{100}\right)\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)$

$= 100000\times\frac{19}{20}\times\frac{11}{10}\times\frac{28}{25} = 117040$

Profit = 117040 – 100000= Rs.17040

13. Question

The population of a town increases at the rate of 40 per thousand annually. If the present population be 175760, what was the population three years ago.

Answer

Given,

Increase rate of population of town = $\frac{40}{1000}\times100 = 4\%\ annually$

Present population of town = 175760

Let population of town 3 years ago was = X

So,

$= X\left(1+\frac{4}{100}\right)\left(1+\frac{4}{100}\right)\left(1+\frac{4}{100}\right) = 175760$

$= X\times\frac{26}{25}\times\frac{26}{25}\times\frac{26}{25} = 175760$

$= X = \frac{(175760\times25\times25\times25)}{26\times26\times26} = 156250$

Hence,

Population of town 3 years ago was = 156250

14. Question

The population of a mixi company in 1996 was 8000 mixies. Due to increase in demand it increases its production by 15% in the next two years and after two years its demand decreases by 5%. What eill its production after 3 years?

Answer

Given,

Population of mixi company in 1996 = 8000

Production growth rate in next 2 years = 15 %

Decrease rate in 3rd year = 5%

So,

Production after 3 years = $8000\left(1+\frac{15}{100}\right)\left(1+\frac{15}{100}\right)\left(1-\frac{5}{100}\right)$

$= 8000\times\frac{23}{20}\times\frac{23}{20}\times\frac{19}{20} = 10051\,.$

15. Question

The population of a city increases each year by 4% of what it had been at the beginning of each year. If the population in 1999 had been 6760000, find the population of the city in (1) 2001 (ii) 1997.

Answer

Given,

Annually increase rate of population of city = 4%

Population in 1999 = 6760000

So ,

i) Population of city in 2001 (2 years after)

$= 6760000\left(1+\frac{4}{100}\right)\left(1+\frac{4}{100}\right)$

$= 6760000 \times \frac{26}{25} \times \frac{26}{25} = 7311616.$

ii) Population of city in 1997 (2 years ago)

$= 6760000\left(1 - \frac{4}{100}\right)\left(1 - \frac{4}{100}\right)$

$= 6760000 \times \frac{21}{25} \times \frac{21}{25} = 6250000$

16. Question

Jitendra set up a factory by investing Rs. 2500000. During the first two successive years his profits were 5% and 10% respectively. If each year the profit was on previous year's capital, compute his total profit.

Answer

Given,

Initial investment by Jitendra = Rs.2500000

Profit in first 2 successive years = 5% & 10%

Final investment after two successive profits = $2500000 \times \frac{105}{100} \times \frac{110}{100} = Rs.2805000$

Hence,

His total profit = 2805000 – 2500000 = Rs.387500

Exercise 14.5

1. Question

Ms. Cherian purchases a boat for Rs. 16000. If the total cost of the boat is depreciating at the rate of 5% per annum, calculate its value after 2 years.

Answer

Given,

Price of boat = Rs.16000

Depreciation rate = 5% per annum

So,

Value of boat after 2 years = $16000\left(1 - \frac{5}{100}\right)\left(1 - \frac{5}{100}\right) = 16000 \times \frac{19}{20} \times \frac{19}{20} = Rs.14440$

2. Question

The value of a machine depreciates at the rate of 10% per annum. What will be its value 2 years hence, if the present value is Rs 100000? Also, find the total depreciation during this period.

Answer

Given,

Present value of machine = Rs.100000

Rate of depreciation = 10% per annum

So,

Value of machine after 2 years = $100000\left(1-\frac{10}{100}\right)\left(1-\frac{10}{100}\right)=100000\times\frac{9}{10}\times\frac{9}{10}=Rs.8100$

Total depreciation during this period = Rs.(100000 – 8100) = Rs.19000

3. Question

Pritam bought a plot of land for Rs. 640000. Its value is increasing by 5% of its previous value after every six

months. What will be the value of the plot after 2 years?

Answer

Given,

Price of land = Rs.640000

Rate of increase = 5% in every six month

So,

Value of plot after 2 years = $640000\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{5}{100}\right)$

$=640000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}=Rs.706440.25$

4. Question

Mohan purchased a house for Rs. 30000 and its value is depreciating at the rate of 25% per year. Find the value of the house after 3 years.

Answer

Given,

Price of house = Rs.30000

Depreciating rate = 25% per year

Value of house after 3 years = $30000\times\left(1+\frac{25}{100}\right)\left(1+\frac{25}{100}\right)\left(1+\frac{25}{100}\right)$

$=30000\times\frac{5}{4}\times\frac{5}{4}\times\frac{5}{4}=Rs.12656.25$

5. Question

The value of a machine depreciates at the rate of 10% per annum. It was purchased 3 years ago. If its present value is Rs. 43740, find its purchase price.

Answer

Given,

Depreciation rate of machine = 10% p.a

Present value of machine = Rs.43740

Let its purchase price 3 years ago = Rs. X

So,

$$=X\left(1+\frac{10}{100}\right)\left(1+\frac{10}{100}\right)\left(1+\frac{10}{100}\right)=43740$$

$$= X \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} = 43740$$

$$= X = \frac{43740 \times 10 \times 10 \times 10}{11 \times 11 \times 11} = 60000$$

Hence,

Purchase price of machine was = Rs.60000

6. Question

The value of a refrigerator which was purchased 2 years ago, depreciates at 12% per annum. If its present value is Rs. 9680, for how much was it purchased?

Answer

Given,

Present value of refrigerator = Rs. 9680

Rate of depreciation = 12%

Let price of it 2 years ago = Rs.X

So,

$$= X\left(1-\frac{12}{100}\right)\left(1-\frac{12}{100}\right) = 9680$$

$$= X \times \frac{22}{25} \times \frac{22}{25} = 9680$$

$$= X = \frac{(9680 \times 25 \times 25)}{22 \times 22} = 12500$$

Hence,

Price of refrigerator 2 years ago was = Rs.12500

7. Question

The cost of a T.V. set was quoted Rs. 17000 at the beginning of 1999. In the beginning of 2000 the price was hiked by 5%. Because of decrease in demand the cost was reduced by 4% in the beginning of 2001. What was the cost of the T.V. set in 2001?

Answer

Given,

Cost of T.V at beginning og 1999 = Rs.17000

Hiked in price in 2000 = 5%

Depreciation in 2001 = 4%

So,

Price of T.V in 2001 = $17000\left(1+\frac{5}{100}\right)\left(1-\frac{4}{100}\right)=17000\times\frac{21}{20}\times\frac{24}{25}=Rs.17136$

8. Question

Ashish started the business with an initial investment of Rs. 500000. In the first year he incurred a loss of 4%. However during the second year he earned a profit of 5% which in third year rose to 10%. Calculate the net profit for the entire period of 3 years.

Answer

Given,

Initial investment by Ashish = Rs.500000

Loss in first year = 4%

Profit in 2^{nd} year = 5 %

Profit in 3^{rd} year = 10%

Hence,

Finally investment becomes = $500000\left(1-\frac{4}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{10}{100}\right)=500000\times\frac{24}{25}\times\frac{21}{20}\times\frac{11}{10}$

= Rs.5090400

Net profit = Rs.(5090400 – 500000) = Rs.554400